

## A revision of *Periploca* (Periplocaceae)

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Revised nomenclature, a new key to the species, improved classification, diagnostic characteristics, geographic distribution and habitat of *Periploca* L. and its fourteen species are presented. *Cyprinia* Browicz is reduced to synonymy with *Periploca*.

**Keywords:** *Periploca*, Periplocaceae, Asclepiadaceae, taxonomy

### Introduction

*Periploca* L. is one of approximately 50 genera in the Periplocaceae, a family related to the Apocynaceae and Asclepiadaceae. Periplocaceae includes about 190 species in Africa, Madagascar, Eurasia and Australasia. The taxa are predominantly climbers, some of which are huge lianas in tropical and sub-tropical swamp, rain or mesophytic forests. However, a number are shrubby scramblers or erect shrubs inhabiting semi-arid to desert habitats. A number of geophytic herbs occur in grassland, savanna, semi-desert and desert, a few are epiphytes.

*Periploca* includes 14 species that occur in Africa, Asia and Europe (Figure 1) which inhabit humid forest, drier savanna or desert scrub. The majority of the *Periploca* species are shrubby scramblers, a few are lianas or erect shrubs.

Browicz (1966) revised the genus *Periploca* and recognised 11 species. He transferred one species, *P. gracilis* Boiss., to a new genus, *Cyprinia* Browicz and described a new species, *P. somaliense*; the description is, however, incomplete, lacking floral characteristics. Goyder & Boulou (1990) added *P. brevicoronata*, a species from Arabia, which proved to be a synonym of *P. somaliense* (Venter & Verhoeven 1993). *Periploca acuminata* Rahman & Wilcock and *P. tsiangii* D. Fang & H.Z. Ling were recently described by Rahman & Wilcock (1992) and Fang & Ling (1994) respectively. Venter & Verhoeven (1996) reinstated *Periploca*

*nigrescens* Afz. which Bullock (1961) combined with *Parquetina gabonica* Baill. and *Omphalogonus calophyllus* Baill. as *Parquetina nigrescens* (Afz.) Bullock.

Schumann (1895) was first to classify *Periploca* species. He recognised section *Euperiploca*, which to a large extent agrees with section *Periploca*, as defined by Browicz (1966), and section *Campelepis* which has no merit, being based on vegetative characteristics only. Browicz's classification (1966) consists of section *Periploca*, which includes series *Periploca* [= *Connatae* Browicz], *Laevigatae* Browicz and *Aphyllae* Browicz, and section *Immaculata* Browicz.

The purpose of this article is to correct the nomenclature of *Periploca*, to provide diagnostic characteristics for the genus and its lower taxa, to compile a new species key and to improve the classification. Further details on nomenclature, descriptions, geographical distribution, economic uses and pollen morphology may be referred to Browicz (1965 & 1966), Jonkers (1991), Rahman & Wilcock (1992), Fang & Ling (1994), Venter & Verhoeven (1993 & 1996) and Verhoeven & Venter (1994).

### Materials and Methods

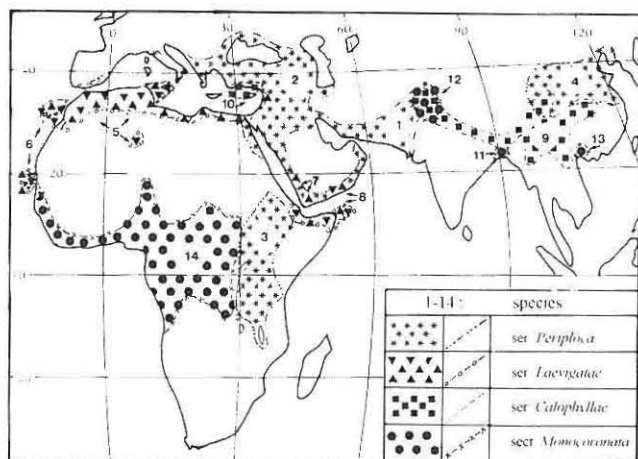
Herbarium material from ABD, BM, BR, COI, FI, G, K, LISC, M, MAL, MO, SRGH, WAG and Z was studied. No fresh material was available and dried flowers from herbarium specimens were rehydrated for analysis. Works listed in the introduction provided further information.

### Account

*Periploca* L., Species plantarum: 211 (1753). Type: *P. graeca* L. [= *Aploca* Neck., *Ehretiana* Coll., *Campelepis* Falc., *Socotora* Balf. f.].

*Cyprinia* Browicz: 124(1965), *comb. nov.* Type: *Cyprinia gracilis* (Boiss.) Browicz

Shrub, scrambler or liana, plants lactiferous. *Leaves* persistent, early deciduous or bracteate, petiolate, opposite, simple, with axillary and interpetiolar dentate colleters, broadly elliptic to linear-elliptic or broadly ovate to linear-ovate, margin entire. *Inflorescences* compact or lax, few to many flowered cymes. *Flowers* bisexual, actinomorphic, pentamerous, semi-epigynous, with gynostegium exposed from the corolla. *Sepals* free, mostly with paired colleters at inner base. *Corolla* rotate; tube shallow, annular, lobes adaxially glabrous or partly to completely hairy, with or without fleshy, dark coloured centres and densely papillose white spots, basally glandular. *Corona* inserted at corolla mouth, lobes simple, basally undivided or bi- or tri-segmented, undivided lobes filiform, linear subulate or ovate, epically entire, bifid or tetradid; bisegmented lobes subulate, trisegmented lobes with central segment filiform or linear, epically entire or bifid, lateral segments fleshy, ovoid-deltoid and fused to adaxial bases of corolla lobes. *Interstaminal discs* distinct, lobular, clasping around style. *Stamens* inserted directly below corona lobes, villous



**Figure 1** Distributions of the sections, series and species of *Periploca*. Section *Periploca*, series *Periploca*: 1. *P. aphylla*, 2. *P. graeca*, 3. *P. linearifolia*, 4. *P. sepium*. Section *Periploca*, series *Laevigatae*: 5. *P. angustifolia*, 6. *P. laevigata*, 7. *P. somaliense*, 8. *P. viscidiformis*. Section *Periploca*, series *Calophyllae*: 9. *P. calophylla*, 10. *P. gracilis*. Section *Monocoronata*: 11. *P. acuminata*, 12. *P. hydaspidis*, 13. *P. tsiangii*, 14. *P. nigrescens*.

or hirsute, anthers adaxially fused to stigmatic head, ovate to hastate, pollen in tetrads. *Stigmatic head* pentangular, ovoid to broadly ovoid, with adaxial spatulate pollen translators alternating with anthers. *Follicles* paired, linear-ovoid to very narrowly ovoid, acutely to horizontally divergent. *Seeds* ovate, compressed, with apical coma of hairs.

### Classification

The present classification of *Periploca* species is based on the presence, or absence, of the following characteristics:

#### 1 Corolla lobes:

- 1.1 Structures: fleshy dark centres, white papillose spots.
- 1.2 Vesture: consistent presence or absence of a specific type of vesture in specific positions.

#### 2 Corona lobes:

- 2.1 Basal segmentation.
- 2.2 Fusion of corona lobes with corolla lobes.

### Section 1 *Periploca*

#### Series 1.1 *Periploca*

1. *P. aphylla* Decne.
2. *P. graeca* L.
3. *P. linearifolia* Quart.-Dill. & A. Rich.
4. *P. sepium* Bunge

#### Series 1.2 *Laevigatae* Browicz

5. *P. angustifolia* Labill.

6. *P. laevigata* Ait.

7. *P. somaliense* Browicz

8. *P. visciformis* (Vatke) K. Schum.

#### Series 1.3 *Calophyllae* Venter

9. *P. calophylla* (Wight) Falc.

10. *P. gracilis* Boiss.

#### Section 2 *Monocoronata* Venter

11. *P. acuminata* Rahman & Wilcock

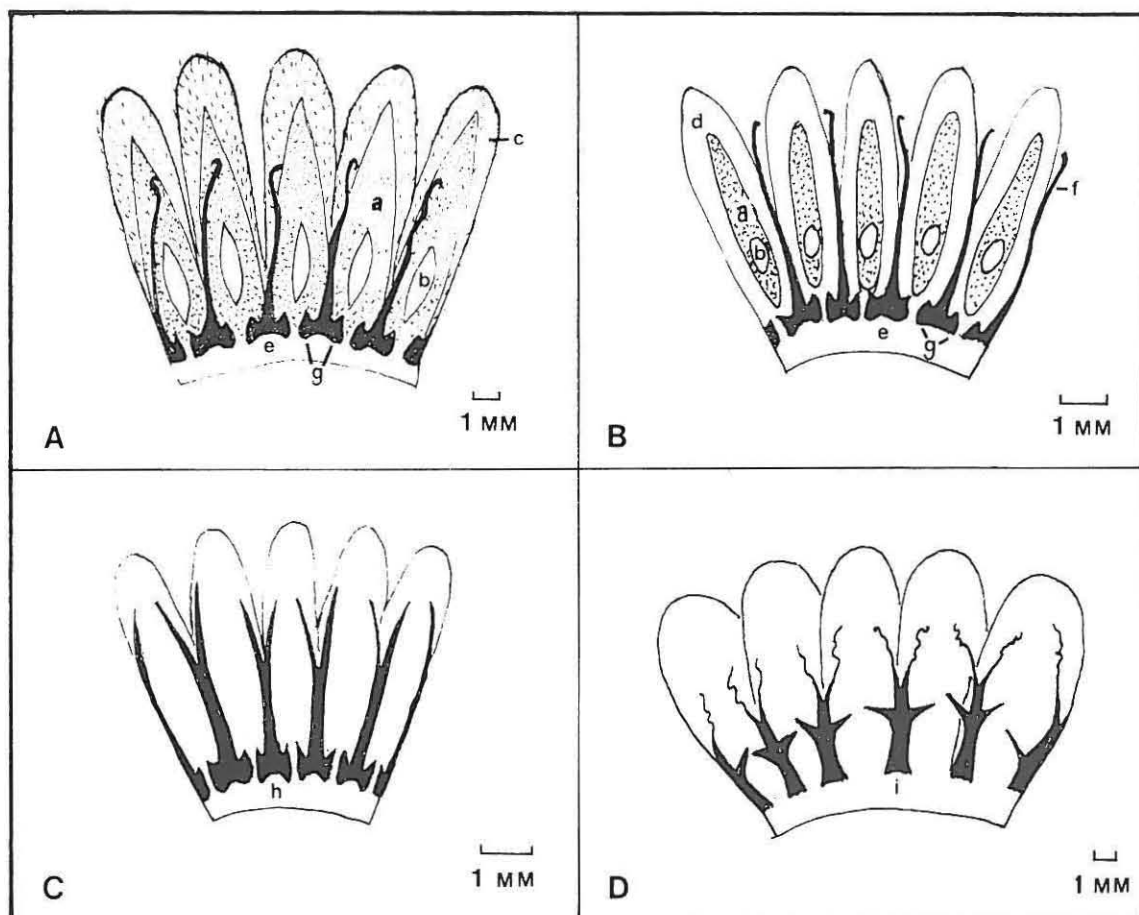
12. *P. hydaspidis* Falc.

13. *P. tsiangii* D. Fang & H.Z. Ling

14. *P. nigrescens* Afz.

Ten species have basally trisegmented lobes, the main natural characteristic for the classification of the species in the genus. Two sections are based on the presence (section *Periploca*, Figure 2A & B) or absence (section *Monocoronata*, Figure 2D) of this characteristic. The dark, glabrous, fleshy centre on the adaxial side of the corolla lobes occurs in nine species and the white papillose spot on this centre in eight species. A villous margin around this centre is present in four species (series *Periploca*, Figure 2A), a glabrous margin in five species (series *Laevigatae*, Figure 2B), two species without the dark centre and white spot are placed in series *Calophyllae* (Figure 2C).

*Periploca linearifolia* has no white spot on its corolla lobes but its villous margin, surrounding the adaxial dark, glabrous, fleshy centre, is typical of series *Periploca* and this species is therefore



**Figure 2** Corollas folded open, showing the characteristics of corolla- and corona lobes in series *Periploca* (A), *Laevigatae* (B), *Calophyllae* (C) and section *Monocoronata* (D). Corolla lobes: a = dark, glabrous, fleshy centre, b = white papillose spot, c = villous margin, d = glabrous margin. Corona lobes: e = basally trisegmented lobes with f = central filiform segment and g = lateral deltoid-ovoid segments, h = trisegmented lobe with linear, apically bifid, central segment, i = basally unsegmented lobe with tetrafid apex. [A. *P. graeca*, Chapman 11921 (K); B. *P. laevigata*, Taubert 321 (G); C. *P. gracilis*, Kennedy 1860 (K); D. *P. nigrescens*, Bos 2492 (K)]

included here. The unsegmented or bisegmented corona lobes of *P. somaliense* markedly differ from the trisegmented corona lobes of section *Periploca* but its corolla lobes, with adaxial white spotted dark centre and glabrous margin, place it in series *Laevigatae*.

*Periploca acuminata*, *P. hydaspidis* and *P. tsiangii*, section *Monocoronata* are related through their unsegmented corona lobes and are all from Asia. *P. nigrescens*, from Africa, differs from the other members of section *Monocoronata* and is probably not closely related to its Asian relatives.

#### Key to the *Periploca* species

- 1a Corona lobes basally trisegmented with central segment filiform, lateral segments ovoid-deltoid and fused to adaxial base of corolla lobes ..... 2
- 1b Corona lobes unsegmented at their bases or bisegmented. .... 10
- 2a Corolla lobes adaxially with dark glabrous fleshy centre, mostly with a white papillose spot in centre ..... 3
- 2b Corolla lobes without dark glabrous fleshy centre or white papillose spot ..... 9
- 3a Corolla lobes adaxially densely villous along their margins around dark centre ..... 4
- 3b Corolla lobes glabrous around dark centre. .... 7
- 4a Climbers with normal, persistent or seasonal, leaves ..... 5
- 4b Erect leafless shrub (leaves bracteate or normal leaves early deciduous), Egypt and Arabian Peninsula to Afghanistan ..... *P. aphylla* (1)
- 5a Adaxial dark centre on corolla lobes with a white papillose spot ..... 6
- 5b Adaxial dark centre on corolla lobes without white papillose spot, eastern and north eastern Africa ..... *P. linearifolia* (3)
- 6a Corolla lobes thin textured, white spot  $\frac{1}{3}$  as long as dark centre; Italy to Iran ..... *P. graeca* (2)
- 6b Corolla lobes thick textured, white spot at least  $\frac{1}{2}$  as long as dark centre; northern and eastern China ..... *P. septum* (4)
- 7a Plant with normal persistent leaves ..... 8
- 7b Plant leafless (leaves bracteate or normal leaves early deciduous), Arabian Peninsula, Socotra and north-eastern Africa ..... *P. viscidiformis* (8)
- 8a Leaves always opposite, 25–70 mm long; foliicles 70–135 mm long, Canary, Savage and Cape Verde Islands. .... *P. laevigata* (6)
- 8b Leaves fascicled on older stems, usually 15–30 (–35) mm long, foliicles 50–70 mm long; northern Africa, southern Europe and Syria. .... *P. angustifolia* (5)
- 9a Corolla lobes ovate, glabrous to pubescent, violet; central segment of corona lobes filiform with entire apex; northern India to Vietnam and China ..... *P. calophylla* (9)
- 9b Corolla lobes narrowly ovate, glabrous, white; central segment of corona lobes linear with deeply cleft bifid apex; Turkey and Cyprus ..... *P. gracilis* (10)
- 10a Corolla lobes without white papillose spot ..... 11
- 10b Corolla lobes with adaxial white papillose spot, NW Somalia and SW Arabian Peninsula ..... *P. somaliense* (7)
- 11a Corona lobes filiform, subulate or ovate, entire ..... 12
- 11b Corona lobes linear and bi- or quadri-fid; Sierra Leone to Zaïre ..... *P. nigrescens* (14)
- 12a Corona lobes filiform or subulate, pubescent or puberulous. .... 13

12b Corona lobes concavely ovate with short filiform apex, glabrous; Bangladesh ..... *P. acuminata* (11)

13a Corona lobes free, linear, pubescent; plants leafless (early deciduous); Pakistan and north-western India ..... *P. hydaspidis* (12)

13b Corona basally annular with lobes subulate; plants foliate; southern China ..... *P. tsiangii* (13)

#### Conspectus of taxa

##### Section 1 *Periploca*

Corona lobes basally trisegmented with central segment filiform, lateral segments ovoid-deltoid and fused to adaxial base of corolla lobes. (Corona lobes rarely simple or bisegmented, if so species with a white spotted dark centre on the adaxial side of the corolla lobes).

##### Series 1.1 *Periploca*

Corolla lobes adaxially villous along margin around glabrous, dark, fleshy centre. Centre mostly having a white papillose spot.

Species 1: *P. aphylla* Decne. in Jacquemont, Voyage dans l'Inde 4: 109, tab. 116 (1844). Type: Pakistan, Djillalapour, Jacquemont 113 (K!, P). [= *Campelepis viminea* Falc]. *P. aphylla* subsp. *laxiflora* (Born.) Browicz: 62 (1966), syn. nov. Type: Oman, Maskat, Bornmüller 511 (W).

Erect, leafless shrub. Leaves bracteate or normal and early deciduous; bracteate leaves acicular, normal leaves ovate to narrowly ovate, 3–12 × 1–5 mm, coriaceous, apex acute to acuminate, lateral veins invisible. Inflorescences compact, 3–15-flowered, mostly few flowered. Corolla lobes spreading, linear-ovate, 5–6 × 2.5–3 mm, fleshy, apex obtuse; adaxially with margin yellowish-brown, centre violet and fleshy; white spot narrowly elliptic and at middle of lobe. Corona lobes with central segment violet, 3–4 mm long, glabrous. Foliicles horizontal, linear ovoid, (50–)60–120(–150) × 5–6 mm.

Distribution: From Egypt along western coast of the Red Sea, Sinai and Arabian Peninsulas to Afghanistan, in arid habitats (Figure 1).

The two subspecies: subsp. *aphylla* and subsp. *laxiflora* (Bornm.) Browicz (*P. aphylla* var. *laxiflora* Bornm.), respectively based on compact or open inflorescences, long or short lateral shoots, presence or absence of vestiture, are not upheld because of variability in these characteristics.

Species 2: *P. graeca* L., Species plantarum: 211 (1753). Type: LINN 307.1 (LINN!, lecto). [= *P. maculata* Moench., *P. laeta* Salisb.]

*P. graeca* var. *vestita* Rohlena: 84 (1911), syn. nov. Type: Yugoslavia, Skadarsko, Rohlena anno 0/871906 (PR, PRC).

Liana. Leaves broadly elliptic, broadly ovate or ovate, 60–100(–130) × 30–50(–80) mm, herbaceous, adaxially glossy, apex acute to acuminate, lateral veins visible, sub-parallel. Inflorescences open, 3–15 flowered. Corolla lobes reflexed, narrowly ovate to very narrowly ovate, 8–10 × 2–3 mm, herbaceous, apex obtuse; adaxially violet with dark centre narrowly ovate, white spot narrowly ovate with acute apices,  $\frac{1}{3}$  as long as dark centre (Figure 2A). Corona lobes with central segment violet, 5–7 mm long, glabrous to sparsely puberulent. Foliicles acutely divergent and apically fused, linear ovoid, 60–90(–150) × 5–7 mm.

Distribution: Italy eastwards into Iran (Figure 1), in moist situations such as humid forests.

The two varieties of *P. graeca*: var. *graeca* and var. *vestita* Rohlena, based on absence or presence of vestiture on petioles and leaves, are not upheld due to the variability of vestiture in the species.



Species 3: *P. linearifolia* Quart.-Dill. & A. Rich. in Annales des Sciences Naturelles-Botanique ser. 2, 14: 263 (1840). Type: Ethiopia, Adowa, *Quartin-Dillon & Petit s.n.* (P, holo; K!, holo). [= *P. linearis* Hochst.]

*P. linearifolia* var. *gracilis* Browicz: 75 (1966), *syn. nov.* Type: Sudan, Lado Yei River, *F. Sillitoe* 260 (K!, holo).

Liana. *Leaves* linear, linear-ovate to very narrowly ovate, 30–65(–90) × 2–5 mm, coriaceous, apex long attenuate, lateral veins visible. *Inflorescences* open, usually many flowered panicle cymes. *Corolla* lobes spreading, oblong-ovate, 3–4 × 1–1.5 mm, sub-herbaceous, apex obtuse; adaxially violet, centre dark violet, fleshy and glandular, villous on margin and apex. *Corona* lobes with central segment filiform, 3–4 mm long, violet, puberulous. *Follicles* horizontal, linear-ovoid, 60–120(–160) × 4–5 mm.

Distribution: Widespread over eastern and north-eastern Africa from Malawi to Ethiopia (Figure 1), in dry savanna to moist forests.

The two varieties of *P. linearifolia*: var. *linearifolia* and var. *gracilis* Browicz, which are based on different leaf sizes, are not upheld.

Species 4: *P. sepium* Bunge, Enumeratio plantarum, quas in China boreali: 43 (1833). Type: China, Beijing, *Bunge s.n.* (K!).

Scrambler. *Leaves* narrowly ovate, 40–120 × 10–40 mm, herbaceous, adaxially glossy, apex acuminate, lateral veins visible. *Inflorescences* lax, 3–15 flowered. *Corolla* lobes reflexed, very narrowly ovate, 6–8 × 3–4 mm fleshy, apex obtuse; adaxially violet-brown with dark centre narrowly ovate and glandular, white spot narrowly ovate with acute tips, at least ½ as long as dark centre. *Corona* lobes with central segment violet, 5–6 mm long, glabrous. *Follicles* acutely divergent and apically fused, linear-ovoid, 90–130(–170) × 4–5 mm.

Distribution: Northern and eastern China in a variety of habitats from forests to mountain scrub (Figure 1).

Series 1.2 *Laevigatae* Browicz, Arboretum Kórnickie 11: 33 (1966).

Type: *P. laevigata* Ait.

Corolla lobes adaxially glabrous around white spotted dark centre.

Species 5: *P. angustifolia* Labill., Icones plantarum Syriae rariorum Dec. 2: 13 (1791). Type: Syria, Latakiah, *Labillardière s.n.* (G!, holo; BM). [= *P. andiacea* Roesch, *P. rigida* Viv., *P. fasciculata* Viv. ex Coss.].

Erect shrub or scrambler. *Leaves* mostly fascicled, linear-ovate to narrowly ovate, 15–30(–35) × 2–4(–8) mm, coriaceous, apex acute to obtuse, lateral veins invisible. *Inflorescences* compact to semi-compact, 2–9(–15) flowered. *Corolla* lobes spreading, narrowly ovate, 4–6 × 2–3 mm, apex obtuse; adaxially violet to maroon, centre dark violet or dark maroon and with elliptic white spot. *Corona* lobes with central segment violet, 4–5 mm long, finely puberulous. *Follicles* horizontal, very narrowly ovoid, 50–70(–90) × 7–10 mm.

Distribution: Northern African Sahara to Egypt, Malta, Spain and Italy, around Sicily and Crete, and Syria (Figure 1) in various arid habitats.

Species 6: *P. laevigata* Ait., Hortus kewensis 1: 301 (1789). Type: Canary Islands, *Masson s.a.* (K!, holo). [= *P. puniceaefolia* Cav., *P. oleaefolia* Salisb., *P. secamone* Lam. ex Decne.], *P. chevalieri* Browicz: 40 (1966), *syn. nov.* Type: Cape Verde Islands, Fogo, Cha das Caldeiras, *Chevalier* 44879 (K!, holo).

Erect shrub or scrambler. *Leaves* narrowly ovate, narrowly elliptic or rarely, elliptic, ovate or obovate, (20–)25–50(–60) × 5–15 mm, cori-

aceous, apex acute to obtuse, bright green above, paler green below, lateral veins visible. *Inflorescences* compact to semi-compact, 3–15 flowered, mostly few-flowered. *Corolla* lobes spreading, narrowly ovate, 5–6 × 2–2.5 mm, fleshy, apex obtuse; adaxially violet to violet-brown, centre dark violet and with elliptic white spot (Figure 2B). *Corona* lobes with central segment violet, 4–5 mm long, finely puberulous. *Follicles* widely to horizontally divergent, very narrowly ovoid, 70–100(–120) × 10–12 mm.

Distribution: Canary, Savage and Cape Verde Islands in various arid habitats (Figure 1).

Browicz (1966) described a new species, *R. chevalieri* which he separated from *P. laevigata* on leaf length/width ratio. This distinction is rather arbitrary especially when *P. laevigata* is considered 'a very variable species with regard to leaf size and shape' by Browicz (1966) himself. Not even on the specimens named by Browicz himself do all the leaves comply with the distinction set and the species is therefore regarded as synonym of *P. laevigata*.

Species 7: *P. somaliense* Browicz in Arboretum Kórnickie 11: 87 (1966); Venter & Verhoeven: 215 (1993). Type: Somalia, Dabalaishe Mountain, *Gillet* 4712 (K!, holo.).

Scrambler. *Leaves* narrowly obovate, narrowly ovate or narrowly elliptic, (20–)40–75 × (5–)10–15 mm, coriaceous, apex obtuse to acute, lateral veins barely visible. *Inflorescences* semi-compact, many flowered. *Corolla* lobes spreading, broadly ovate to broadly obovate, 2.5–4 × 1.5–2 mm, glabrous, fleshy apex obtuse; adaxially yellowish-green to pale yellow, centre darker, glandular and with triangular white spot. *Corona* reddish, fleshy, 1–1.5 mm long, unsegmented lobes ovate to narrowly ovate, apices entire or bifid and acute to acuminate; bisegmented lobes subulate to very narrowly ovate, apices acute to acuminate. *Follicles* horizontally divergent, very narrowly ovoid, 50–85 × 7–8 mm.

Distribution: North-western Somalia, Yemen and Saudi Arabia (Figure 1) in semi-arid mountain scrub.

Species 8: *P. visciformis* (Vatke) K. Schum. in Natürliche Pflanzenfamilien 4, 2: 216 (1895). *Leptadenia visciformis* Vatke: 146 (1876). Type: Somalia, Meid, *Hildebrandt* 1432 (BM!). [= *Socotora aphylla* Balf. f., *S. visciformis* (Vatke) Bullock, *Leptadenia ephedriiformis* Desfl., *Periploca ephedriiformis* (Desfl.) Schweinf. ex Desfl., *P. aphylla* Chiov. (non Decne.)]

*P. visciformis* var. *glabra* Browicz: 69 (1966) *syn. nov.* Type: Socotra, south-west of Galonsir, *Balfour* 327 (K!).

Erect, leafless shrub. *Leaves* bracteate or normal and early deciduous; bracteate leaves acicular; normal leaves linear-ovate, 10–15 × 1–1.5 mm, coriaceous, apex acute, lateral veins invisible. *Inflorescences* compact, 1–3-flowered. *Corolla* lobes spreading, narrowly ovate, 5–6 × 1–2 mm, fleshy, apex obtuse; adaxially with margin yellow to yellowish-green, centre dark violet-brown to violet-red, glandular and with elliptic white spot. *Corona* lobes with central segment greenish, 4–6 mm long, glabrous. *Follicles* horizontally divergent, linear-ovoid, 30–60 (–80) × 3–5 mm.

Distribution: Southern Arabian Peninsula, Socotra, Somalia and Ethiopia (Figure 1) mainly in gravelly arid mountain wadis, especially sheer cliffs of these washes.

Browicz (1966) distinguishes two varieties: var. *visciformis* and var. *glabra* based on vestiture. However, I disagree with the distinction and the two varieties are regarded here as mere variants.

Series *Calophyllae* Venter, *ser. nov.*

*Corollae lobi adaxialiter sine centro fusco glabro succulento vel macula alba papillosa.*

Corolla lobes adaxially without any dark glabrous, fleshy centre or white papillose spot.

Species 9: *P. calophylla* (Wight) Falc. in Proceedings of the Linnean Society London 1: 115 (1842). *Streptocaulon calophyllum* Wight: 65 (1834). Type: India, Himalaya Mountain, *Falconer s.n.* (K!, holo).

*P. calophylla* subsp. *forrestii* (Schltr.) Browicz: 79 (1966), *syn. nov.* Type: China, hills west of Yunnanfu, *G. Forrest* 572 (E, holo; P!).

*P. calophylla* subsp. *floribunda* (Tsiang) Browicz: 81 (1966), *syn. nov.* Type: China, hills west of Tengyueh, *G. Forrest* 25318 (E, holo; BM, K!).

Liana. *Leaves* very narrowly elliptic to elliptic or very narrowly ovate to ovate, (30–)40–90(–110) × (4–)6–20(–27) mm, sub-coriaceous, glossy, apex caudate to long caudate, lateral veins conspicuous and sub-parallel. *Inflorescences* semi-compact to open, 3–10-flowered axillary cyme or raceme of numerous opposite cymes. *Corolla* lobes spreading, ovate, 3–6 × 2–2.5 mm, sub-herbaceous, apex rounded to acute; adaxially violet, darker on glabrous midvein, sparsely to densely pubescent. *Corona* lobes with central segment violet, 3–4 mm long, pubescent. *Follicles* acutely divergent, linear-ovoid, 80–150(–200) × 4–5 mm.

Distribution: Northern India to northern Burma, south-western China and northern Vietnam (Figure 1) mainly in forests along stream banks in mountainous areas.

Browicz (1966) reduced *P. forrestii* and *P. floribunda* to subspecies of *P. calophylla*. However, these three subspecific taxa are not clearly separable and are here regarded as variants of one 'exceptionally variable species' (Browicz 1966). Li (1985) distinguishes two varieties, var. *calophylla* and var. *mucronata* in *P. calophylla* which may also prove to be variants of this variable species.

Species 10: *P. gracilis* Boiss., *Flora Orientalis* 4: 50 (1879). Type: Turkey, Tchoupourlu, *Balansa* 719 (G, holo, K!).

*Cyprinia gracilis* (Boiss.) Browicz: 124 (1965), *syn. nov.*

Scrambler. *Leaves* ovate to elliptic, 25–50 × 7–20 mm, coriaceous, adaxially green, abaxially green mottled reddish, apex acuminate to acute, lateral veins largely visible. *Inflorescences* semi-compact, few flowered. *Corolla* lobes spreading, narrowly ovate, 5–6 × 1.3–1.5 mm, white, glabrous, herbaceous, apex obtuse. *Corona* lobes with central segment linear, 4–5 mm long deeply bifid, glabrous (Figure 2C). *Follicles* acutely to horizontally divergent, linear-ovoid, ca. 80 × 2–4 mm.

Distribution: Southern Turkey and Cyprus in macechia and forests on rocky terrain.

Browicz (1965) transferred *P. gracilis* to the new genus *Cyprinia* because of its distinct linear bifid corona lobes when the filiform corona lobes were regarded as diagnostic for *Periploca*. The ovate corona lobes of *P. somaliense* and *P. acuminata* only later became known (Rahman & Wilcocks 1992, Venter & Verhoeven 1993) and Browicz's transfer thus made sense. The incorrect transfer of *Periploca nigrescens*, with its linear tetrafid corona lobes, to *Parquetina* Baill. by Bullock (1961) might also have influenced Browicz (1965) in his decision. The present retransfer of *Cyprinia gracilis* to *Periploca* was greatly influenced by the trisegmented condition of the corona lobes of *P. gracilis* which is unique to *Periploca*.

Section 2: *Monocoronata* Venter, *sect. nov.* Type: *P. nigrescens* Afz.

*Coronae lobi basi non segmentati*.

Corona lobes at their bases unsegmented.

Species 11. *P. acuminata* Rahman & Wilcock in Botanical Journal of the Linnean Society 110: 373 (1992). Type: Bangladesh,

Sylhet Tamabil-Jaflong Hills, *Rahman & Hossain* 56 (ABD!, holo, BM!).

Scrambler. *Leaves* ovate to elliptic, 90–120 × 40–50 mm, sub-coriaceous, apex acuminate, lateral veins visible. *Inflorescences* semi-compact, few flowered. *Corolla* lobes spreading, ovate, 4–6 × 3–4 mm, fleshy, apex obtuse, adaxially brown and pubescent. *Corona* lobes broadly ovate and concave with short filiform apex, 1.5 mm long, glabrous. *Follicles* horizontally divergent, narrowly ovoid, 50–60 × 15–20 mm.

Distribution: Bangladesh in the Tamabil-Jaflong Hills of the Sylhet District.

Species 12: *P. hydaspidis* Falc. in proceedings of the Linnean Society London 1: 115 (1842). Type: Kashmir, Kutao Kelah, *Falconer* 991 (K!, holo).

Scrambler. *Leaves* bracteate or normal and early deciduous; bracts acicular, normal leaves linear-ovate, 15–40 × 1–3 mm, coriaceous, apex acuminate, lateral veins invisible. *Inflorescences* compact to semi-compact, 3–15-flowered. *Corolla* lobes spreading, ovate, 2–2.5 × 1–1.2 mm, sub-herbaceous, apex obtuse; adaxially violet, pubescent. *Corona* lobes filiform, 1.5–2 mm long, pubescent. *Follicles* possibly horizontal, linear-ovoid, 65–130 × 3–4 mm.

Distribution: Northern Pakistan and north-western India (Figure 1), in mountainous regions.

Species 13: *P. tsiangii* D. Fang & H.Z. Ling in *Guihaia* 14: 122–123 (1994). Type: China, Guangxi, Duan, Banling, *Feng Guili* anno 04/10/1978 (GXMI, holo).

Glabrous scrambler. *Leaves* narrowly ovate, rarely linear, 20–60 × 3–12 mm, apex acuminate, base cuneate, lateral veins visible, sub-parallel. *Inflorescences* semi-compact, few-flowered. *Corolla* lobes spreading, linear-lanceolate, 11–13 × 1.5–2.0 mm, reddish violet, abaxially glabrous, adaxially puberulous along midrib. *Corona* annular at base, lobes subulate, 5–6 mm long, puberulous, *Follicles* unknown.

Distribution: Guangxi Province in southern China (Figure 1).

Species 14: *P. nigrescens* Afzelius, *Stirpium in Guinea* 1: 2 (1817), Venter & Verhoeven: 27 (1996). Type: *Anon s.n.* (BM!). [= *Parquetina gabonica* Baill., *P. nigrescens* (Afz.) Bullock, *Periploca preussii* K. Schum., *P. gabonica* (Baill.) A. Chev.].

Liana. *Leaves* mostly elliptic, also ovate to narrowly ovate, (75–)125–140(–160) × (30–)45–75(–110) mm, papery to fleshy coriaceous apex, rounded to obtuse and cuspidate, shiny and bright green above, pale green below, lateral veins conspicuous, sub-parallel. *Inflorescences* semi-open, 15–30-flowered. *Corolla* reflexed, elliptic to ovate, 10–12 × 4–5 mm, glabrous except at base hirsute, fleshy coriaceous, apex rounded; adaxially with base velvety and deep crimson to deep purple or black purple, glandular, turning dark brown to brown towards apex. *Corona* lobes filiform or linear, 5–7 mm long, greenish white to pale yellow, 2–4 segmented above middle, rarely undivided, upper two segments tortuous (Figure 2D). *Follicles* horizontal, linear-ovoid and 2-edged, 120–210 × 12–20 mm. (Plant parts turn black when drying).

Distribution: Tropical Africa, from Sierra Leone and Guinea to the eastern border of Zaïre (Figure 1), in tropical forest and savanna.

## Discussion and Conclusions

The genus *Periploca* is widely distributed over Africa, Europe and Asia. Ten species are known in Asia, of which seven are exclusive to Asia. Africa has seven species, three being

exclusive. Europe has two species, but none exclusive. Series *Periploca* is an Afro-Eurasian group of species, series *Laevigatae* is an Afro-Euro-Mediterranean group, series *Calophyllae* is an Asian group (Figure 1). Section *Monocoronata* is Afro-Asian, but is not a closely coherent group (Figure 1).

Section *Monocoronata* includes the least modified species in the genus. Series *Laevigatae* is the most advanced. All of its members are xerophytes with the highest degree of modifications as to the corolla (white spotted dark, glandular centres) and corona (mostly trisegmented and fused to corolla lobe bases). The leafless (early deciduous) xerophytes, *P. visciformis* (series *Laevigatae*) and *P. aphylla* (series *Periploca*) are probably the most advanced members of the genus.

*Buckollia* Venter & Verhoeven, *Schlechterella* K. Schum, *Tacazzea* Decne and *Zacateza* Bullock have flowers quite similar to those of *Periploca*. All of these genera have rotate flowers with mostly filiform outer corona lobes and anthers with pollen tetrads. *Periploca*, however, has more floral modifications such as those mentioned above for the corolla and corona and may be regarded as the most advanced among these genera. Had it not been for the absence of staminal hairs in *Buckollia* this genus may well have been placed in section *Monocoronata* of genus *Periploca*.

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